Physics 129: Problem Set #6
Due: Wed Oct 17 at 5PM
Homework Box available on 2^{nd} Floor LeConte breezeway

1. We saw in class that the interpretation of the J/ψ to be a $c\overline{c}$ bound state was supported by the partial width for its decay to leptons.

   (a) Perkins 4.3. Note: you may use the arguments from p. 125 of Perkins

   (b) Use the results of Perkins 4.3 and the measured ψ and Υ leptonic widths to deduce how $|\psi(0)|^2$ depends on the mass of the vector meson. Is this dependence what you would expect from your experience with positronium?

2. Perkins 4.5

3. Perkins 4.6

4. We saw in class that the ratio of cross sections

$$R = \frac{e^+e^- \rightarrow hadrons}{e^+e^- \rightarrow mu^+mu^-}$$

   depends on the number of colors and the sum of the square of the quark charges (see Perkins section 5.2). Before the top was discovered, no one knew how heavy it was. People use measurements of R as a way of searching for top. What value of R would be expected at energies high enough to produce $t\overline{t}$ pairs in e^+e^- collisions?

5. The LEP experiments at CERN all performed detailed studies of quark fragmentation into jets. One outcome of these studies was the measurement of the strong coupling constant α_s. Pick one paper describing this measurement and write a short (1/2 to 1 page) description of the measurement. Include in your writeup a reference to what paper you read, as well as descriptions of what parts of the detector were used, what physical quantities were measured and what analysis was done to extract α_s

Notes:

- On Monday Oct 15, Professor Shapiro's office hours will be before class (11AM to noon) instead of after class.
- Professor Shapiro will be out of town the first week in Dec. She would like to reschedule the classes for that week to fit in two $1\frac{1}{2}$ hour sessions. Here are a list of possible dates. Please check your calendars. A questionaire asking for your preferred dates will be handed out in class next week.

Possible Dates and Times for Rescheduled classes

Tues Oct 30	4PM-5:30PM
Tues Oct 30	5PM-5:30PM
Tues Nov 6	4PM-5:30PM
Tues Nov 6	5PM-6:30PM
Mon Nov 26	5:30PM-7PM
Tues Nov 27	5PM-6:30PM
Wed Nov 28	4PM-5:30PM
Wed Nov 28	5PM-6:30PM